

WE CLAIM:

1. A molecular melt composition comprising:
 - a) an antioxidant; and
 - 5 b) a Coupling Agent.
2. The composition of Claim 1, wherein at least one reactive group of the coupling agent is selected from the group consisting of groups capable of forming a nitrene, groups capable of forming a carbene, and mixtures thereof.
3. The composition of Claim 1, wherein the coupling agent is selected from the group
 - 10 consisting of sulfonyl azides, poly(sulfonyl azides), phosphazene azides, poly(phosphazene azides), silyl azides, poly(silyl azides), formyl azides, poly(formyl azides), azides, poly(azides), salts of N-chlorosulfonamides, N, N dichlorosulfonamides, the inner salts of 2-trialkyl-1-sulfonylhydrazides, diazo alkanes, poly(diazo alkanes), geminally-substituted methylene groups, ketenes,
 - 15 metallocarbenes, and mixtures thereof.
4. The composition of Claim 1, wherein the coupling agent comprises poly(sulfonyl azide).
5. The composition of Claim 4, wherein the coupling agent comprises bis sulfonyl azide
- 20 6. The composition of Claim 5, wherein the coupling agent is 4,4'-Oxydibenzenesulfonylazide or derivatives thereof.
7. The composition of Claim 1, wherein the antioxidant is selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and
 - 25 derivatives thereof, hindered phenolic compounds and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.
8. The composition of Claim 1, wherein the antioxidant comprises a phenolic compound.
9. The composition of Claim 1, wherein the antioxidant comprises a hindered phenolic
 - 30 compound.
10. The composition of Claim 1, wherein the antioxidant is tetrakis [Methylene (3,5-di-*t*-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof.

11. The composition of Claim 10, wherein the Coupling Agent comprises a bis sulfonyl azide.

12. The composition of Claim 11, wherein the Coupling Agent is 4,4'-Oxydibenzenesulfonylazide or derivatives thereof.

13. The composition of Claim 1, wherein the Molecular Melt exhibits a total crystallinity of less than about 95 weighted average weight percent as measured by DSC.

14. The composition of Claim 1, wherein the Molecular Melt exhibits a total crystallinity of less than about 60 weighted average weight percent as measured by DSC.

15. The composition of Claim 1, wherein the molecular melt exhibits a total crystallinity of less than about 20 weighted average weight percent as measured by DSC.

16. The composition of Claim 1, wherein the molecular melt exhibits a total crystallinity of less than about 10 weighted average weight percent as measured by DSC.

17. The composition of Claim 1, wherein the molecular melt exhibits a total crystallinity of less than about 5 weighted average weight percent as measured by DSC.

18. The composition of Claim 1, wherein the molecular melt exhibits a total crystallinity of less than about 1 weighted average weight percent as measured by DSC.

19. The composition of Claim 1, wherein the antioxidant is tetrakis [Methylene (3,5-di-t-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof and the coupling agent comprises a bis sulfonyl azide.

20. The composition of Claim 1, wherein the antioxidant is a lactone or derivatives thereof.

21. The composition of Claim 1, further comprising a second antioxidant.

22. The composition of Claim 21, wherein the second antioxidant is octacecyl-3-(3,5-di-t-butyl-4-hydroxyphenyl)-propionate.

23. The composition of Claim 1, further comprising additional polymer additives.

24. The composition of Claim 23, wherein the additional polymer additives are selected from the group consisting of internal lubricants, compatibility agents, release agents, plasticizers, ultra-violet stabilizers, catalyst neutralizers, and mixtures thereof.

25. The composition of Claim 23, wherein the additional polymer additives comprise internal lubricants.
26. The composition of Claim 25, wherein the internal lubricant is PEG.
27. The composition of Claim 25, wherein the internal lubricant is PPG.
- 5 28. The composition of Claim 25, wherein the internal lubricant is GMS.
29. The composition of Claim 1, wherein the antioxidant and coupling agent are present in a molar ratio of about 1:1 or greater.
30. A molecular melt composition comprising:
- a) an antioxidant; and
- 10 b) a modifying agent.
31. The composition of Claim 30, wherein a reactive group of the modifying agent is selected from the group consisting of a nitrene and a carbene.
32. The composition of Claim 30, wherein the modifying agent is selected from the group consisting of sulfonyl azides, phosphazene azides, silyl azides, formyl azides,
- 15 azides, salts of N-chlorosulfonamides, N, N dichlorosulfonamides, the inner salts of 2-trialkyl-1-sulfonylhydrazides, diazo alkanes, geminally-substituted methylene groups, ketenes, metallocarbenes, and mixtures thereof.
33. The composition of Claim 30, wherein the modifying agent comprises a sulfonyl azide.
- 20 34. The composition of Claim 30, wherein the antioxidant is selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and derivatives thereof, hindered phenolic compounds and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.
- 25 35. The composition of Claim 30, wherein the antioxidant comprises a phenolic compound.
36. The composition of Claim 30, wherein the antioxidant comprises a hindered phenolic compound.
37. The composition of Claim 30, wherein the antioxidant is tetrakis [Methylene
- 30 (3,5-di-*t*-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof.

38. The composition of Claim 30, wherein the modifying agent contains functional heteroatoms in addition to those present on the groups forming the carbene or nitrene group.
39. The composition of Claim 30, wherein the modifying agent contain a functional group in addition to the group forming the carbene or nitrene group.
40. The composition of Claim 39, wherein the functional group is selected from the group consisting of: amides, imides, epoxy, esters, carboxylic acids, hydroxy groups, anhydrides, amino groups, and mixtures thereof.
41. A method for phlagmatizing a coupling agent contained in a liquid comprising the step of: introducing an antioxidant into the liquid.
42. The method of Claim 41, wherein the coupling agent is suspended in the liquid.
43. The method of Claim 41, wherein the coupling agent is dissolved in the liquid.
44. The method of Claim 41, wherein the liquid is part of a reaction mixture within which the coupling agent is produced.
45. The method of Claim 44, wherein the antioxidant is introduced into the reaction mixture prior to the coupling agent being produced.
46. The method of Claim 44, wherein the antioxidant is introduced into the liquid after the coupling agent is formed.
47. The method of Claim 41, wherein the coupling agent is a poly (sulfonyl azide).
48. The method of Claim 41, wherein the antioxidant is selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and derivatives thereof, hindered phenolic compounds and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.
49. The method of Claim 48, wherein the antioxidant is tetrakis [Methylene (3,5-di-*t*-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof and wherein the antioxidant is introduced into the liquid after the coupling agent is formed.
50. A method for phlagmatizing a modifying agent contained in a liquid comprising the step of: introducing an antioxidant into the liquid.
51. The method of Claim 50, wherein the modifying agent is suspended in the liquid.
52. The method of Claim 50, wherein the modifying agent is dissolved in the liquid.

53. The method of Claim 50, wherein the liquid is part of a reaction mixture within which the modifying agent is produced.
54. The method of Claim 53 wherein the antioxidant is introduced into the reaction mixture prior to the modifying agent being produced.
- 5 55. The method of Claim 53, wherein the antioxidant is introduced into the liquid after the modifying agent is formed.
56. The method of Claim 50, wherein the modifying agent is a sulfonyl azide.
57. The method of Claim 50, wherein the antioxidant is selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and
- 10 derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and derivatives thereof, hindered phenolic compounds and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.
58. The method of Claim 50, wherein the modifying agent contains a functional group in addition to the group forming the carbene or nitrene group.
- 15 59. The composition of Claim 50, wherein the functional group is selected from the group consisting of: amides, imides, epoxy, esters, carboxylic acids, hydroxy groups, anhydrides, amino groups, and mixtures thereof.
60. A method for making a molecular melt, comprising the steps of: introducing an antioxidant into a liquid containing a coupling agent; and recovering the molecular
- 20 melt.
61. The method of Claim 60, wherein the coupling agent is suspended in the liquid.
62. The method of Claim 60, wherein the coupling agent is dissolved in the liquid.
63. The method of Claim 60, wherein the liquid is part of a reaction mixture within which the coupling agent is produced.
- 25 64. The method of Claim 63, wherein the antioxidant is introduced into the reaction mixture prior to the coupling agent being produced.
65. The method of Claim 63, wherein the antioxidant is introduced into the liquid after the coupling agent is formed.
66. The method of Claim 60, wherein the coupling agent is a poly (sulfonyl azide).
- 30 67. The method of Claim 60, wherein the antioxidant is selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and

derivatives thereof, hindered phenolic compounds and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.

68. The method of Claim 67, wherein the antioxidant is tetrakis [Methylene (3,5-di-
t-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof and wherein the antioxidant
5 is introduced into the liquid after the coupling agent is formed.

69. The method of Claim 60, wherein the molecular melt is recovered from the liquid by precipitating the molecular melt from the liquid.

70. The method of Claim 60, wherein the molecular melt is recovered from the liquid by co-crystallizing the antioxidant and the coupling agent.

10 71. A method for making a coupled polymer comprising the steps of:

- (a) mixing a molecular melt with a polymer; and
- (b) reacting the molecular melt with the polymer.

72. The method of Claim 71, wherein the reacting is caused by heating the molecular melt and the polymer.

15 73. The method of Claim 72, wherein the method is carried out in a mixer that mixes the molecular melt and polymer and provides sufficient heat to cause reaction between a coupling agent of the molecular melt and the polymer.

74. The method of Claim 73, wherein the method is carried out in a polymer extruder.

20 75. The method of Claim 73, wherein the coupling agent is a poly(sulfonyl azide).

76. The method of Claim 73, wherein the molecular melt is comprised of an antioxidant selected from the group consisting of phenolic compounds and derivatives thereof, hindered amines and derivatives thereof, amine hydroxides and derivatives thereof, thioester compounds and derivatives thereof, hindered phenolic compounds
25 and derivatives thereof, lactones and derivatives thereof, and mixtures thereof.

77. The method of Claim 73, wherein the coupling agent is selected from the group consisting of sulfonyl azides, poly(sulfonyl azides), phosphazene azides, poly(phosphazene azides), silyl azides, poly(silyl azides), formyl azides, poly(formyl azides), azides, poly(azides), salts of N-chlorosulfonamides, N, N
30 dichlorosulfonamides, the inner salts of 2-trialkyl-1-sulfonylhydrazides, diazo alkanes, poly(diazo alkanes), geminally-substituted methylene groups, ketenes, metallocarbenes, and mixtures thereof.

78. The method of Claim 76, wherein the antioxidant is tetrakis [Methylene (3,5-di-
t-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof and wherein the coupling
agent is 4,4'-Oxydibenzenesulfonylazide or derivatives thereof.
79. The method of Claim 71, wherein the polymer to be coupled is a polyolefin.
- 5 80. The method of Claim 73, wherein the polymer to be coupled is a propylene
based polymer.
81. The method of Claim 80, wherein sufficient coupling agent is utilized to
produce a rheologically modified propylene based polymer.
82. The method of Claim 80, wherein sufficient coupling agent is utilized to
10 produce a coupled propylene based polymer having crosslinked networks.
83. The method of Claim 81, wherein the antioxidant is tetrakis [Methylene (3,5-di-
t-butyl-4-hydroxyhydrocinnamate)] or derivatives thereof and wherein the coupling
agent is 4,4'-Oxydibenzenesulfonylazide or derivatives thereof.